# PATENT SPECIFICATION

648,863

Date of filing Complete Specification (under Section 16 of the Patents and Designs Acts, 1907 to 1946) Dec. 16, 1948.

Application Date Dec. 17, 1947. No. 33366/47.

Application Date June 25, 1948. No. 17228/48.

Complete Specification Published Jan. 17, 1951.

Index at acceptance:—Classes 21, A8(b: d), E(5: 12: 13a: 13b: [illegible] 4), D1c, D3b1(b: d), D(7c: 13: 17).



PROVISIONAL SPECIFICATION
No. 33366, A.D. 1947.

## Improvements in or relating to Containers for Liquids, Powders and like Substances

I, WILLEM VAN LEER, of 78, Bridge Road East, Welwyn Garden City, Hertfordshire, a Subject of the Queen of the Netherlands, do hereby declare the nature of this invention to be as follows:—

This invention concerns improvements in or relating to containers (e.g. drums, barrels, or the like) for liquids, powders and like substances, and has particular reference to containers for liquids or powders which are of a corrosive character, e.g. which would corrode metal.

According to the invention a container is provided which comprises an outer shell or casing formed of steel or any other appropriate metal or material of sufficient strength to withstand the normal rough usage that containers encounter during transportation, this shell or casing being furnished internally with a flexible impermeable lining which contains the substance to be transported in the container and isolates it from the outer shell or casing of the latter.

Conveniently the said outer shell or casing is in the nature of a drum or barrel formed of steel or other suitable metal and having an inlet opening in one end or otherwise suitably disposed therein. The flexible impermeable lining is preferably in the form of a sac disposed within the drum or barrel, and having its neck located concentrically with the said inlet opening and furnished with a rubber or like resilient or compressible collar which is located in this opening and has a portion or flange lying on the outside surface of the drum or barrel around the inlet opening thereof.

A closure plate is provided for the inlet opening to the sac and may comprise a flat, e.g. aluminium plate, which is pressed into tight engagement with the said collar of the sac by means of nuts on a series of studs arranged on the drum or barrel around the inlet opening and passing through said collar flange and the closure plate, or by any other suitable fastening means. Thus the flange of the collar of the sac forms a sealing packing for the container.

The said closure plate should be of a material not corrodible by the contents of the container.

The said closure plate may be furnished with a bung hole, tap or the like for use in withdrawing the contents of the container therefrom.

The said sac may be formed of rubber, rubberized fabric, a flexible synthetic resin material or any other suitable flexible material suitable for the purpose and not corrodible by the contents which the drum or barrel is intended to contain.

The sac is conveniently introduced into the drum or barrel through the inlet opening therein by rolling the sac into a rod-like form, the sac being expanded within the drum after being introduced thereinto, either by filling it with the liquid which it is to contain or by first inflating it pneumatically.

Dated the 17th day of December, 1947.
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[Price 2/-]

PROVISIONAL SPECIFICATION
No. 17228, A.D. 1948.

# Improvements in or relating to Containers for Liquids, Powders and like Substances

I, WILLEM VAN LEER, a Subject of the Queen of the Netherlands, of 78, Bridge Road East, Welwyn Garden City, Hertfordshire, do hereby declare the nature of this invention to be as follows:—

This invention concerns improvements in or relating to containers (e.g. drums, barrels, tanks or the like) for containing and transporting liquids, powders and like substances, and has particular reference to containers for the transport of liquids or powders which are of a corrosive character, e.g. which would corrode metal, and for food substances where the contamination, even if very slight, of the foot by the metal is not permissible.

According to this invention a container is provided which comprises in combination an outer shell formed of steel or any other appropriate metal or material of a self-supporting character and of sufficient strength to withstand the normal usage that such containers are likely to encounter during transportation, such shell having an inlet and outlet opening and means whereby such opening may be sealed but the container being otherwise of an air-tight construction; and a flexible impermeable lining arranged internally within the said shell so as to contain the substance to be transported in the container whilst isolating this substance entirely from the said shell, and the air in the space initially between the lining and the inner surface of the shell being wholly or substantially wholly expelled or evacuated to ensure that the lining fits snugly at all or substantially all parts thereof against the inner surface of the shell.

Tests have shown that where a flexible impermeable lining is introduced into the shell but without expelling evacuating the air from the space between the lining and the shell, the lining does not fit closely to the shell at all parts of the surface thereof and particularly at corners as, for example in the case of a cylindrical drum, at the junctions of the ends of the drum with the cylindrical wall thereof and consequently the lining is unsupported at these parts by the shell and is therefore under considerable stress when the container is filled with the material to be transported therein so that these unsupported highly stressed parts of the lining are liable to fracture so permitting the material in the container to come into contact with the outer shell of the latter and thereby negativing or detracting from the beneficial results obtained by the use of a lining.

The said outer shell is conveniently in the nature of a drum or barrel (but may be of other form, e.g. the tank of a transport vehicle or vessel) formed of steel or other suitable metal and having an inlet opening in one end or in any other suitably disposed position. The flexible impermeable lining is preferably in the form of a sac disposed within the shell and formed of rubber, synthetic rubber, a flexible synthetic resin, such as polyvinyl chloride, or any other suitable flexible material, preferably somewhat elastic, impermeable to and uncorrodible by or inert to the substance which is to be transported in the container, said flexible lining being reinforced or not as desired with textile or other filaments in woven or other form.

The sac is conveniently introduced into the container through the inlet opening therein and is then expanded within the drum after being introduced thereinto, such expansion preferably being effected by expanding the sac internally by means of air under pressure whilst venting the space between the flexible lining and the shell to permit the air in the said space to be evacuated, the said vent or vents then being sealed. Alternatively, or additionally, the sac may be expanded by evacuating the air from between the shell and the sac and/or by introducing thereinto the material to be transported in the container, or in any other way, the important thing being to expel or extract all or substantially all the air entrapped between the sac and the shell.

The neck of the sac is arranged to make an air-tight seal with the shell at the filling orifice thereof and the means for venting the said space between the shell and the sac may be of various forms. Thus conveniently the shell may have one or more sealable venting holes suitably disposed therein. For example, there may be a sealable venting hole in one or both ends of the shell or in one or both ends and in the peripheral wall of the shell, such hole or holes preferably being provided at or adjacent those positions in the shell where the sac would be likely to be unsupported by the container if air were entrapped therein and not evacuated or expelled at these positions. Removable plugs or other closure means (e.g. solder) may be used to close the said venting holes after the expulsion or extraction of the air from the space between the shell and the sac.

Alternatively, or as well the sac, may be provided or formed with one or more internal venting tubes communicating at their inner ends with the space between the sac and the shell of the container, such tube or tubes enabling air to escape from the space between the sac and the shell when the sac is expanded or inflated (as, for example, blowing air thereinto or by filling it with the material which it is to contain) and/or which tube or tubes enable the space between the sac and the shell to be evacuated by an evacuation pump or similar device.

After the withdrawal or expulsion of the air from the said space the said tube or tubes are sealed off and are then tucked into the sac. Preferably the said tube or tubes are flexible and long enough to extend, when desired, outwardly through the inlet opening of the shell.

The mouth or inlet of the flexible lining is located coaxially with the inlet opening of the shell and is furnished with a rubber or like resilient or compressible neck gland or collar which is located in the said inlet opening of the shell and has a flange lying around this opening on the outer surface of the shell. This collar preferably also has another flange which annularly overlies the material of the shell on the inside thereof and around the said inlet opening, the marginal part of the sac around the mouth of the latter being vulcanised or otherwise permanently and air-tightly sealed to this inner flange of the said collar. Thus the collar is in the nature of a centrally apertured disc or a ring which is externally peripherally grooved to receive an annular marginal portion of the material of the drum surrounding the inlet opening thereof

A closure plate is provided for the inlet opening of the shell and sac and comprises a rigid plate which may be flat and formed of aluminium or other suitable material, this plate fitting over, and being pressed into tight engagement with, the outer surface of the said collar of the sac by means of nuts on a series of spaced studs arranged on the shell in a ring around the inlet opening of the latter and passing through the outer flange of the said collar and through the said closure plate. The said studs may be carried directly by the said shell or alternatively may be carried by a reinforcing ring disposed within the shell around the inlet opening thereof and which may be loosely associated with the shell or be welded or otherwise rigidly associated therewith.

The said nuts on the closure plate holding studs are preferably of a character that are not easily undone without a special tool so that the seal of the sac with the shell cannot easily be tampered with once having been made.

Alternatively any other suitable means may be provided for securing the said closure plate in its sealing position.

The closure plate may itself have an opening or openings furnished or each furnished with a screw-in bung or plug or any other closure device which, when removed, will enable the contents of the container to be emptied in the usual manner.

The closure plate should preferably be made of a material not corrodible by or likely to contaminate the contents of the container, or alternatively it may be lined with a material similar to that of which said sac is formed and the said bung or like closure member may be similarly lined.

The said sac may be produced on a former by a dipping, spraying, or like process or it can be fabricated from sheet material.

Although it is desired that the flexible sac should be supported throughout by the said shell, sufficient air may be left in the shell to act as a cushion for the sac at certain locations, for example, in a cylindrical drum, at the junctions of the peripheral and end walls to prevent the sac entering the usual peripheral recesses at these junctions.

It will be understood that the lining closely follows the internal contour of the shell irrespective of what this may be, i.e. whether it is regular or irregular and the lining maintains this form even if the shell is damaged or bulged.

Extracting all or substantially all the air from between the sac and the shell enables the sac to be made, if desired, of much lighter grade material than would be possible where the sac is largely unsupported externally by the shell of the container.

When the containers are sent abroad the linings or sacs, which are detachable from the shells, can be returned to this country for reuse in new containers even if the shells cannot conveniently be returned, it only being necessary to break the air seal between the shell and the sac in order to remove the sac.

Dated the 25th day of June, 1948.

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COMPLETE SPECIFICATION

## Improvements in or relating to Containers for Liquids, Powders and like Substances

I, WILLEM VAN LEER, a Subject of the Queen of the Netherlands, of 78, Bridge Road East, Welwyn Garden City, Hertfordshire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention concerns improvements in or relating to containers (e.g. drums, barrels, tanks or the like) for containing and/or transporting liquids, powders and like substances and more particularly has reference to metal containers for the transport of substances which are of a material such as to corrode the container or are likely to be undesirably contaminated by contact with the container. Thus the invention is especially applicable to containers for the transport of corrosive substances, particularly liquids, or foodstuffs the contamination of which, by the container, must be avoided.

According to this invention there is provided a container comprising a self-supporting shell furnished internally with a separate lining sac formed of flexible air-tight material impermeable and inert to the substance to be transported or stored in the container, the sac being insertable into the shell through an opening in the latter and being caused to conform closely to the interior contour of the shell by evacuation or expulsion of the air within the shell through outlets or vents communicating with the interior of the shell and wherein the sac has a filling opening defined by a resilient flanged neck portion which is adapted to be fitted into the opening in the shell the outer surface of the neck portion forming with the inner peripheral surface of the said opening in the shell an air-tight joint to prevent the ingress of air into the space between the sac and metal shell during and subsequent to evacuation or expulsion of the air from such space, (for the purpose of bringing the sac into contact with the inside surface of the shell) through the said outlets or vents communicating with the interior of the shell, the said outlets or vents being sealed after withdrawal of the air to maintain a vacuum within the shell.

According to a further feature of the present invention a container for the transportation of substances in liquid, powder or other form, especially those of a corrosive character, comprises an outer self-supporting shell of rigid material having a lining consisting of a sac of flexible material inert and impermeable to the substance to be carried, the outer shell having an opening through which the sac, in a collapsed condition, can be inserted into, or withdrawn from, the interior of the shell, the sac having a filling opening defined by a neck portion in the form of a resilient grommet having a pair of outwardly directed flanges and which is secured to the sac by bonding the latter to one of said flanges, the portion of the grommet between the said flanges being assembled in the filling opening in the shell with the unattached flange of the grommet situated outside the shell, and the said portion of the grommet between the flanges being adapted to form, with the periphery of the opening in the shell, an air-tight joint to prevent the ingress of air into the space between the sac and the metal shell during evacuation or expulsion of air from such space (for the purpose of bringing the sac into contact with the inside surface of the shell) through one or more outlets or vents communicating with the interior of the shell.

According to a further feature of the present invention means are provided for clamping or compressing a peripheral part of the said neck portion or grommet between itself and the shell, to make an air-tight seal between the neck portion or grommet and the shell.

According to a still further feature of the invention the said shell and/or the sac is or are furnished with one or more sealable outlets or vents at or adjacent opposite ends of the same for the expulsion or withdrawal of air from between the shell and the lining sac.

Thus the shell, which will usually be of a cylindrical or drum form, may have a sealable vent hole in each of its opposite ends through which the air originally in the space between the lining sac and the shell may be withdrawn, for inflating the sac or filling it with liquid which may be the substance which the drum is adapted to contain, and subsequently sealed to maintain the vacuated interspace in this condition so as to ensure that the pressure within the sac will maintain the walls of the latter in contact with the inner surface of the shell throughout substantially the whole area thereof.

A vent hole is preferably provided at both ends of the shell since when expelling the air from the said interspace the sac will usually first bed against the shell annularly at a position roughly midway between the opposite ends of the shell and

thereby prevent the free flow of air from one end of the shell to the other. By providing vents at both ends of the shell the air can be withdrawn or expelled from the interspace at either end of the shell.

Alternatively or in addition the sac may have a port or ports communicating with the interspace between itself and the shell and a flexible tube may lead from the, or each of these, ports so as to be extensible through the filling orifice of the shell to enable the air to be drawn from the said interspace through these tubes after which the latter may be sealed in order to close the interspace in an air-tight manner, the flexible tube or tubes then being tucked into the expanded lining sac.

Tests have shown that where a lining sac is introduced into the shell without vacuating the same interspace, the lining does not fit closely to the shell and is indeed at several places, particularly the corners between the cylindrical wall and the ends in the case of a cylindrical drum, unsupported by the shell and is therefore under considerable stress at these parts when the container is filled with the substance to be transported therein, these unsupported highly stressed parts of the lining sac being very liable to fracture and so to permit the material in the sac to come into contact with the shell and thereby negative or seriously detract from the beneficial results obtained by the use of a lining. With the present invention however, the production of an airtight seal around the opening in the shell and also outlets or vents communicating with opposite ends of the said shell the lining is caused to conform closely to the contour of the interior of the shell around the interior walls and ends and in the corners.

Accordingly with the present invention, where the complete containers cannot economically be returned, as from overseas, because of high freightage costs, the sac can be removed from the shell collapsed into small bulk and returned for use in a new shell, the sealing arrangement provided by the present invention always ensuring that a positive seal or airtight joint around the opening in the shell will be obtained thereby permitting a high degree of removal of air from the container to be obtained.

The said outer shell is conveniently in the nature of a drum (although it may be of other forms, e.g. the tank of a transport vehicle or vessel) formed of steel or other suitable metal having sufficient rigidity to be self-supporting and resistant to bursting under normal methods of transport. The drum will normally have a single filling and discharge opening at one end and in such a case the said sac may have a neck grommet peripherally sealed into said opening, a closure being provided to close the said neck. Alternatively the sac may be bonded to a tubular plug screwed or otherwise fitted into the filling orifice of the shell and itself furnished with a screw-in or other suitable removable plug closure member.

The said lining, and if desired the said grommet, may be formed of natural rubber, synthetic rubber, a flexible synthetic resin such as polyvinyl chloride or any other suitable flexible material which is preferably of a somewhat elastic character, is impermeable to air and also impermeable to and preferably uncorrodible by or inert to the substance which is to be carried in the container, and the said lining sac may be, if desired, of a multi-ply construction or be reinforced is, for example, by textile or other filaments in woven or other form.

By ensuring as herein set forth that the sac will conform closely to the interior of the shell so as to be externally supported at all or substantially all parts by the shell of the container it is possible to make the lining sac of a lighter grade material, and therefore less expensively, than would be the case were the sac unsupported in the corners and at other parts externally by the container shell.

It has been previously proposed to provide containers for transporting corrosive substances with a lining formed of flexible non-corrodible air-tight material and having an opening through which the lining is filled with the substance to be transported, the container having holes through which the air may be expelled from between the lining and container as the lining is filled, the said lining being thus capable of conforming to the inner contour of the container.

In order that the nature of this invention may be more readily understood and carried into practice certain embodiments of the same will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is a sectional perspective view showing one half of a metal drum for the transport of liquids or powders and constructed in accordance with this invention;

Figure 2 is a similar view to Figure 1 showing the upper part of the drum prior to the bringing of the lining sac into contact with the walls of the shell;

Figure 3 is a plan of the drum shown in Figure 1;

Figure 4 is an enlarged vertical cross-sectional elevation of the upper part of the same drum;

Figure 5 is an enlarged vertical sectional elevation of a portion of the upper end of a modified form of the drum shown in Figures 1 to 4, the modification consisting in an alternative means for mounting the neck of the lining sac in the filling orifice of the drum and the sealing of the filling orifice of the drum; and

Figures 6 and 7 illustrate further modifications of the arrangement shown in Figures 1 to 4, these modifications incorporating a flexible tube for the withdrawal of air from the interspace between the lining sac and the drum.

Referring to Figures 1 to 4 of the drawings it will be seen that the container there illustrated is in the form of a drum which comprises a cylindrical metal shell 1 closed at its upper and lower ends 2 and 3 in an air-tight manner. The peripheral wall of the drum is circumferentially corrugated at 4 in the usual manner for strength, and the top 2 of the shell is provided with a circular filling orifice 5 which, in the example illustrated, is eccentrically disposed with relation to such top. Around the marginal edge of this filling orifice 5 and on the inner side of the top 2 of the shell, is arranged a reinforcing ring 6, see Figure 4 particularly, which may be separate from the top 2 or be welded thereto and which carries a series of equi-angularly spaced upstanding screw-threaded studs 7 passing through the top 2 of the shell and serving to receive nuts 8 to clamp a closure plate 9 in position over the neck of the filling orifice of the shell, such closure plate being furnished with holes for the passage therethrough of the studs 7.

The upper and lower ends 2 and 3 of the drum are respectively provided with peripherally reinforced vent holes 10 and 11 respectively closed by screw-in or other suitable plugs 12 and 13 which may be sealed by solder or in any other suitable way if desired after being plugged into the holes 10 and 11 respectively.

A flexible and somewhat elastic lining sac 14 is provided for the shell 1 and is introduced into the latter through the filling orifice 5 of the shell. This flexible sac should be formed of a material which is impermeable to air and impermeable and chemically inert to the substance the drum is to contain so as not to be corroded by such substance or contaminate it. Thus the filling sac may be made of rubber, synthetic rubber, a flexible synthetic resin such as a polyvinyl resin, e.g. polyvinyl chloride.

The sac may be produced on a former by dipping, spraying, or like process, or it can be fabricated from sheet material, be moulded, or be made in any other suitable way best suited to the material used, and it may be reinforced with textile or other filaments in woven or other form, or in any other way as desired.

The neck 15 of the sac has sealing surfaces which are arranged to make an air-tight seal with the shell 2 around the filling orifice 5 and, in the arrangement shown in Figures 1 to 4, the neck 15 of the sac is furnished with a collar or grommet 16 formed of rubber, synthetic rubber, polyvinyl chloride, or like resilient material, this grommet being located in the filling orifice 5 of the shell and having a flange 17 lying around this orifice on the outer surface of the top 2 of the shell. This grommet also has another flange which lies under the top 2 of the drum around the filling orifice 5, and the marginal part of the sac 14 around the neck 15 is vulcanised or otherwise permanently and air-tightly sealed to the upper side of this inner flange 18 of the grommet, this flange preferably being of outwardly and downwardly inclined form on the said upper surface thereof as shown in Figure 4.

Thus the said grommet 16 is in the nature of a ring which is externally peripherally grooved to receive an annular marginal portion of the top of the drum surrounding the filling orifice 5 thereof, and the upper flange 17 of the grommet is located by the studs 7 which pass through equi-angularly spaced holes in the flange.

The closure plate 9 for the filling orifice of the shell and for the neck of the sac comprises a rigid plate which is preferably flat and formed of aluminium or other suitable material which is not likely to be corroded by or to contaminate the material to be carried in the drum, this plate fitting over the studs 7 and on to the upper flange 17 of the grommet 16, the cover plate being tightened down on to the said flange 17 by means of the nuts 8 on the studs 7 so as to make an air-tight joint between the top 2 of the shell and the plate 9. The studs 7 are, as explained above, preferably carried rigidly by the top 2 of the drum but they could be separately formed if desired.

The nuts 8 may be of a form that require a special tool to enable them to be undone so that the seal of the lining sac with the shell cannot easily be tampered with once having been made.

The closure plate 9 itself is preferably provided with a central orifice 19 fitted with a screw-in bung or plug 20 or any other closure device (e.g. a tap) which, when removed or opened, will enable the contents of the container to be emptied in the usual manner. The said bung or

plug or other closure device is preferably formed of the same material as the plate 9.

If desired the closure plate 9 may be lined with material similar to that of which the said sac is formed and similarly the said bung or like closure member 20 may be so lined.

Having introduced the sac 14 into the shell 1 with the bungs or plugs 10 and 13 removed from the upper and lower ends of the shell, and having affixed the closure plate 9 (without its bung or plug 20) to the shell with the grommet 16 fitted around the filling orifice 5 of the shell and so making an air-tight seal at this position between the shell and the neck of the sac 14, the sac is extended to its full limit by inflating or expanding it internally within the shell. This inflation or expansion of the sac drives out the air entrapped in the interspace 21 between the lining 14 and the shell 1 and thus enables the outer surface of the sac to seat upon the inner surface of the shell throughout substantially the whole area of the latter whereby the sac is externally supported at all parts and even at the corners between the peripheral and end walls of the shell to a substantial extent. Whilst the sac is inflated or expanded in this way the plugs 10 and 13 are replaced in their ends 2 and 3 of the shell and, if not automatically sealed by fitting them into their vent holes 10 and 11, are sealed by soldering or in any other suitable manner. On now relieving the pressure within the sac it will be found that the latter does not collapse but remains in its close adherence to the inner surface of the shell, following the contour of the latter closely and having frictional engagement therewith.

In the modified arrangement shown in Figure 5 the grommet 16 shown in Figures 1 to 4 is dispensed with and the top 2 of the shell is furnished with an upstanding internally screw-threaded boss 22 into which is screwed an internally screw-threaded plug 23 reduced externally in diameter at 24 at its lower end and having the portion 15 of the sac 14 bonded in an air-tight manner thereabout, the plug thereby forming the neck of the container. The threads of the plug 23 therefore co-operate with the threads of neck 22 to make an air-tight joint, a screw-in closure plug 25 being provided to close the bore of the plug 23.

In the modification shown in Figure 6, the arrangement is similar to that shown in Figures 1 to 4 with the addition that a flexible vent tube 26 is arranged between the sac 14 and the shell 1 along the bottom, up one side and partially along the top of the sac, the tube 26 being formed of rubber or any other suitable material which will not collapse under the pressure of the expanded sac and which will serve to permit air entrapped in the interspace 21 to escape along the tube to the vent hole 10 in the upper end of the shell as the lining sac 14 is expanded. If desired the vent tube 26 may have a series of holes 27 therealong to facilitate the escape of the entrapped air in the said interspace 21 during the expansion of the sac. In this case the vent at the bottom of the shell may be omitted if desired. If desired the tube 26 may be bonded to the sac 14.

Referring to the modification shown in Figure 7 it will be seen that the drum is in all respects similar to that shown in Figures 1 to 4 with the addition that the sac 14 is itself provided with at least one flexible venting tube 28 which extends from any convenient part of the lining sac, e.g. from the bottom part of the same, so as to enable air entrapped in the interspace 21 between the sac and the drum to be withdrawn from this space via the tube 28 which is adapted to be drawn through the opening 19 in the closure plate 9 during evacuation of the air from interspace 21 and subsequently to be sealed off and then tucked back into the interior of the sac. The evacuation of the space 21 can be effected solely by the tube 28, or through two or more of such tubes connected to different parts of the sac, or with the aid of one or more of the vent holes 10 and 11 and with or without the internal inflation of the sac.

If desired the air vents could be fitted with non-return valves to prevent the return of air to the said interspace during the vacuation thereof.

In some cases the expansion of the lining sac to effect the expulsion of air from the interspace 21 through the venting means, may be effected by the filling of the sac itself with the substance to be transported or stored in the container.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A container comprising a self-supporting shell furnished internally with a separate lining sac formed of flexible air-tight material impermeable and inert to the substance to be transported or stored in the container, the sac being insertable into the shell through an opening in the latter and being caused to conform closely to the interior contour of the shell by evacuation or expulsion of the air within the shell through outlets or vents communicating with the interior of the shell

and wherein the sac has a filling opening defined by a resilient flanged neck portion which is adapted to be fitted into the opening in the shell, the outer surface of the neck portion forming, with the inner peripheral surface of the said opening in the shell, an airtight joint to prevent the ingress of air into the space between the sac and metal shell during and subsequent to evacuation or expulsion of the air from such space (for the purpose of bringing the sac into contact with the inside surface of the shell) through the said outlets or vents communicating with the interior of the shell, such outlets or vents being sealed after withdrawal of the air to maintain a vacuum within the shell.

2. A container for the transportation of substances in liquid, powder or other form, especially those of a corrosive character, comprising an outer self-supporting shell of rigid material having a lining consisting of a sac of flexible material inert and impermeable to the substance to be carried, the outer shell having an opening through which the sac, in a collapsed condition, can be inserted into, or withdrawn from, the interior of the shell, the sac having a filling opening defined by a neck portion in the form of a resilient grommet having a pair of outwardly directed flanges and which is secured to the sac by bonding the latter to one of said flanges, the portion of the grommet between the said flanges being assembled in the filling opening in the shell with the unattached flange of the grommet situated outside the shell, and the said portion of the grommet between the flanges being adapted to form, with the periphery of the opening in the shell, an air-tight joint to prevent the ingress of air into the space between the sac and the metal shell during evacuation or expulsion of air from such space (for the purpose of bringing the sac into contact with the inside surface of the shell) through one or more outlets or vents communicating with the interior of the shell.

3. A container according to claim 1 or claim 2 wherein means are provided for clamping or compressing a peripheral part of the said neck portion or grommet between itself and the shell, to make an air-tight seal between the neck portion or grommet and the shell.

4. A container according to claims 1, 2 or 3 wherein the said shell and/or the sac is or are provided with sealable outlets or vents at or adjacent opposite ends of the same.

5. A container according to claim 1 or 2 wherein the periphery of the filling opening in the sac is bonded to a tubular plug fitted in an air-tight manner into the filling opening of the said shell and furnished with a removable plug or other closure member.

6. A container according to any of the preceding claims wherein each outlet vent is formed by providing holes through the wall thickness of the shell, said holes being plugged and sealed after removal of air from the interior of the shell.

7. A container according to claim 4 wherein the said sac has one or more ports communicating with the interspace between itself and the shell and a flexible tube for each of said ports leading from such port through the sac and adapted to be extended through the filling opening of the shell to enable air within the said interspace to be drawn from the latter through the said tube, after which the latter may be sealed off and tucked into the sac.

8. A container having a protective lining substantially as herein described with reference to Figures 1 to 4 of the accompanying drawings.

9. A container having a protective lining substantially as herein described with reference to Figure 5 of the accompanying drawings.

10. A container having a protective lining substantially as herein described with reference to Figure 6 of the accompanying drawings.

11. A container having a protective lining substantially as herein described with reference to Figure 7 of the accompanying drawings.

Dated the 16th day of December, 1948.

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Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1951.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 2s. per copy; by post 2s. 1d. may be obtained.

FIG. 1.

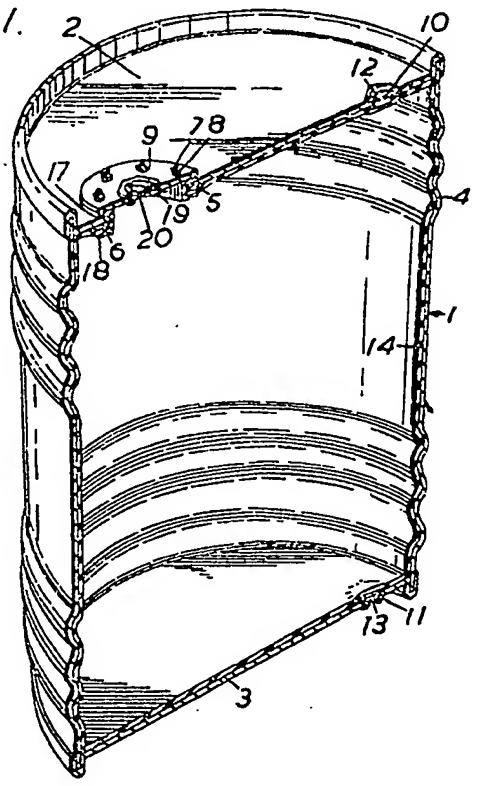



FIG 2.

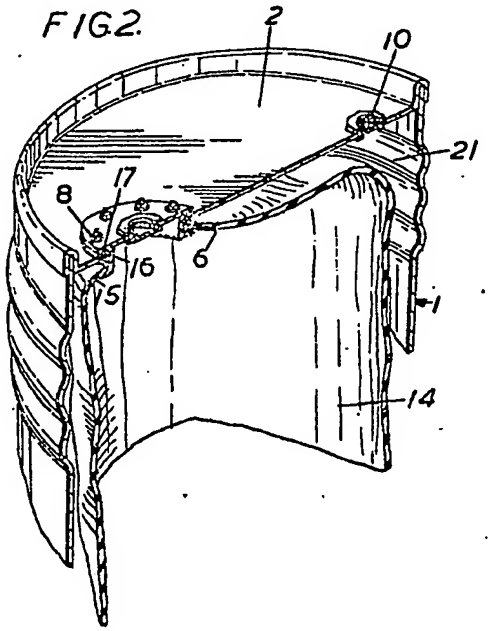


FIG.3.

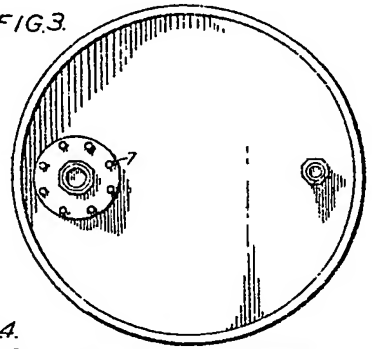



FIG.4.

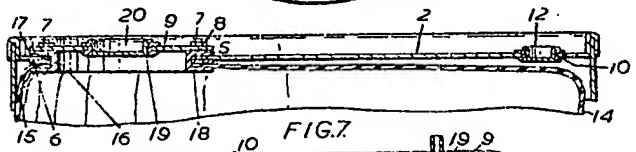



FIG.7.

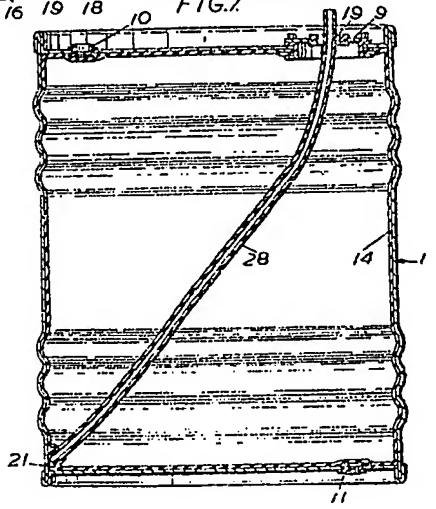



FIG.5.

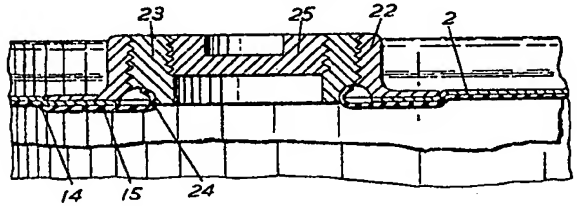



FIG.6.

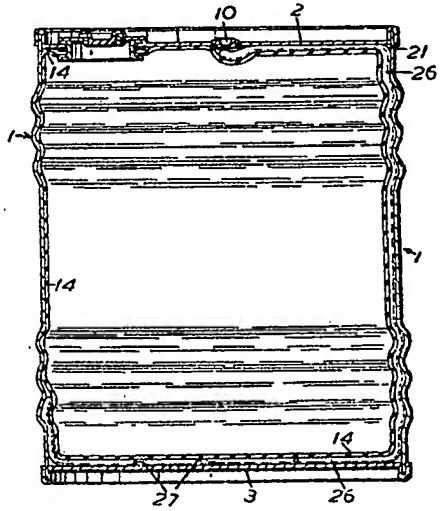


FIG.3.

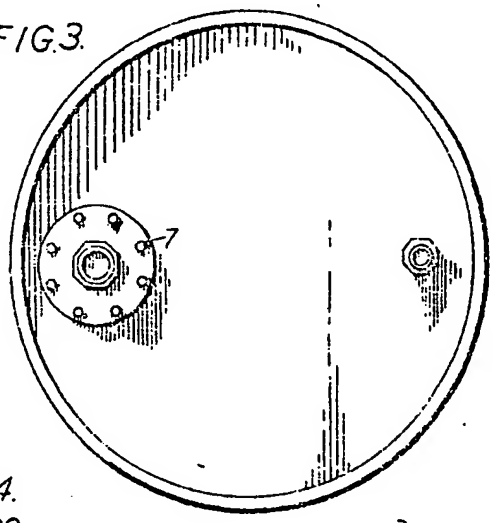



FIG.4.

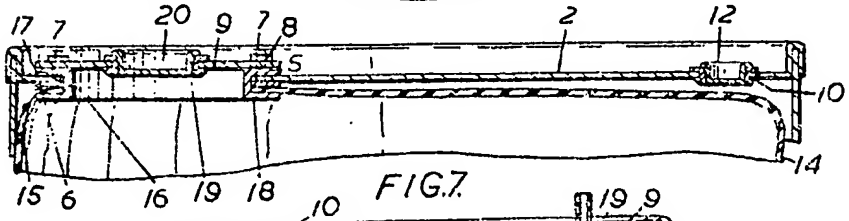
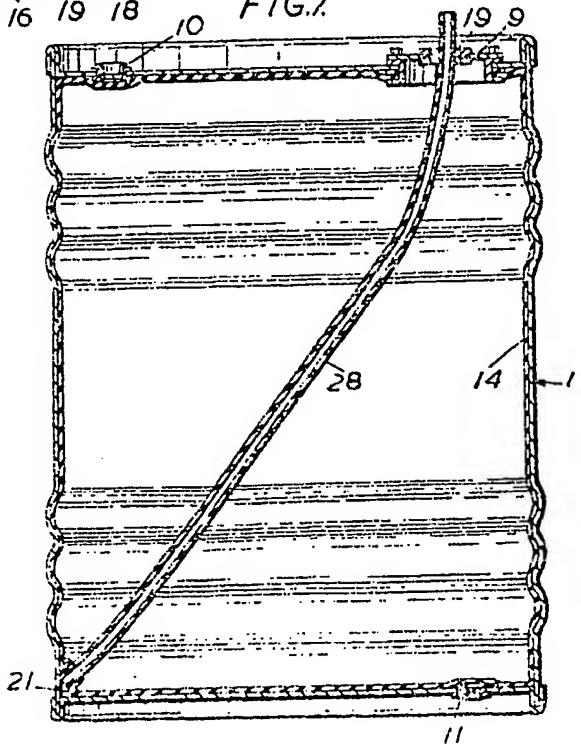
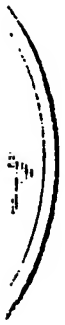


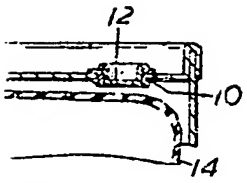

FIG.7.

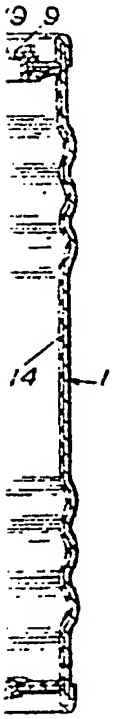



[This Drawing is a reproduction of the Original on a reduced scale.]

SHEET 2






SHEET 3

FIG.5.

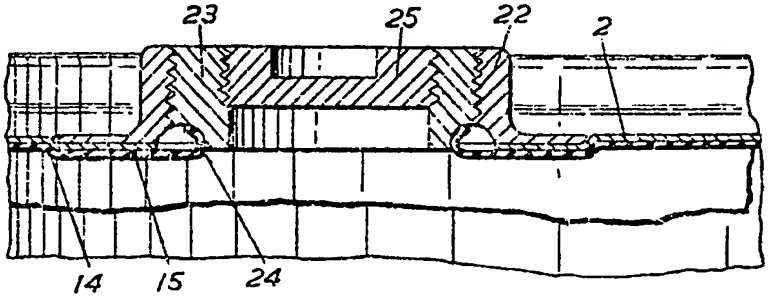



FIG.6.